

POSIDON Science Flight Report

2016-10-28 RF09

Takeoff: 0108 UT October 28 (11:08 Oct 28 Guam local)

Landing: 0633 UT October 28 (16:33 local), duration: 4.5 hours

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Pilots: Gregory Johnson, Dom Del Rosso

Summary:

This flight provided additional measurements of TTL cirrus downstream of deep convection and additional characterization of the western Pacific ozone distribution in the upper troposphere. The highlight of the flight was detection of SO₂ enhancements in the TTL near the southern end of the flight track from volcanic emissions in the area.

Flight Description:

On the days leading up to the flight, the GEOS-5 chemical forecasts indicated persistent SO₂ enhancements at 100–150 hPa south of Guam near the maximum range of the WB-57. On the morning of the flight, a route slightly east of due south (toward the island of Manus) was chosen to target a dense part of the forecast SO₂ plume and avoid deep convection further west.

The aircraft headed south and climbed through convectively-generated cirrus. As on previous flights, the aircraft porpoised through the TTL between about 45 and 55–57 kft. On the northern section of the flight track, a deep, nearly-isothermal layer was noted between about 54 and 56 kft, with thin cirrus throughout and ozone increasing with altitude up to mixing ratios greater than 100 ppbv. The cold-point temperatures on this flight were a few K warmer (~190 K) than on previous flights. Narrow layers with very high concentrations of small ice crystals were detected by the FCDP instrument.

South of about 5°N, the NOAA-SO₂ instrument detected increased sulfur dioxide concentrations (see Figures 1 and 2), as predicted by the GEOS-5 forecasts. Nadir satellite measurements had indicated enhanced low-level SO₂ concentrations over the region from active volcanoes in the area. The WB-57 observations of enhanced SO₂ confirm the model prediction that deep convection efficiently transports sulfur dioxide to the TTL.

All instruments performed well. SID3 was not flown because of a computer failure.

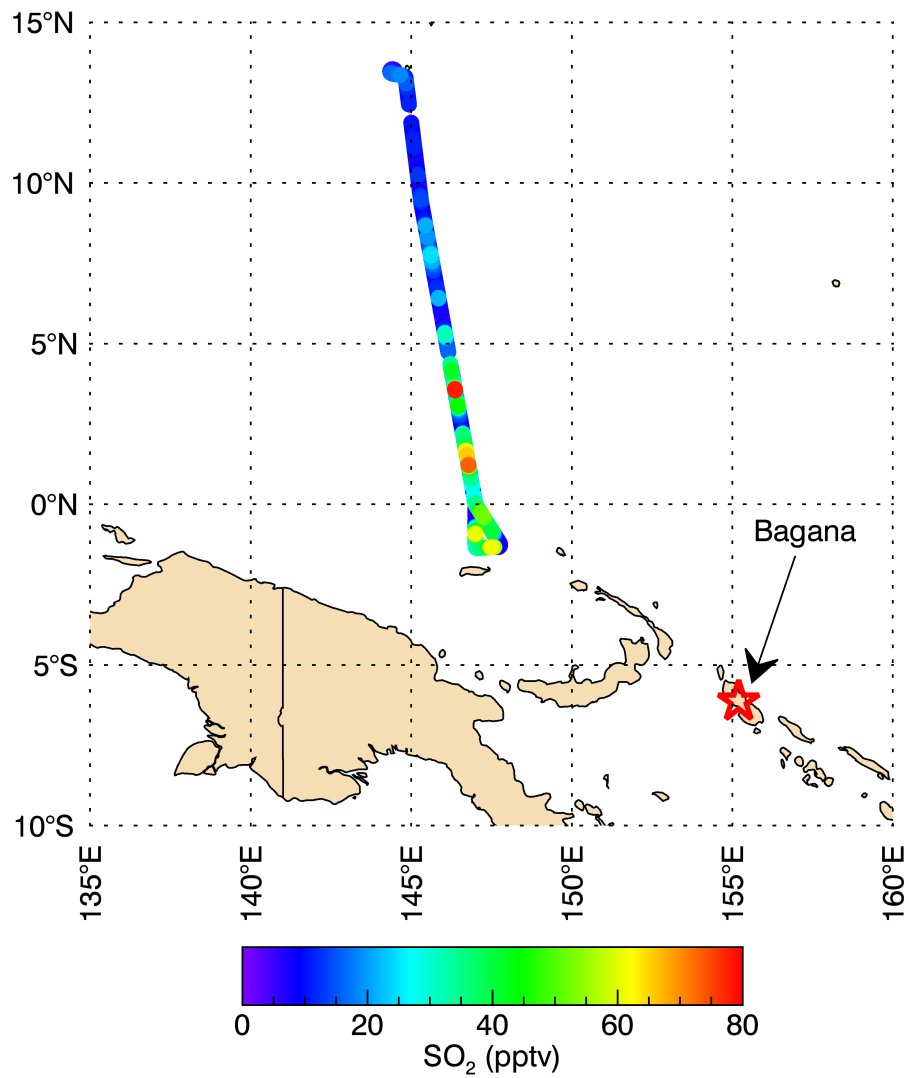


Figure 1. SO₂ mixing ratio is shown in color along the WB-57 flight path toward Manus and back. Enhancements from volcanic emissions (transported to the TTL by deep convection) are apparent. (Courtesy Drew Rollins.)

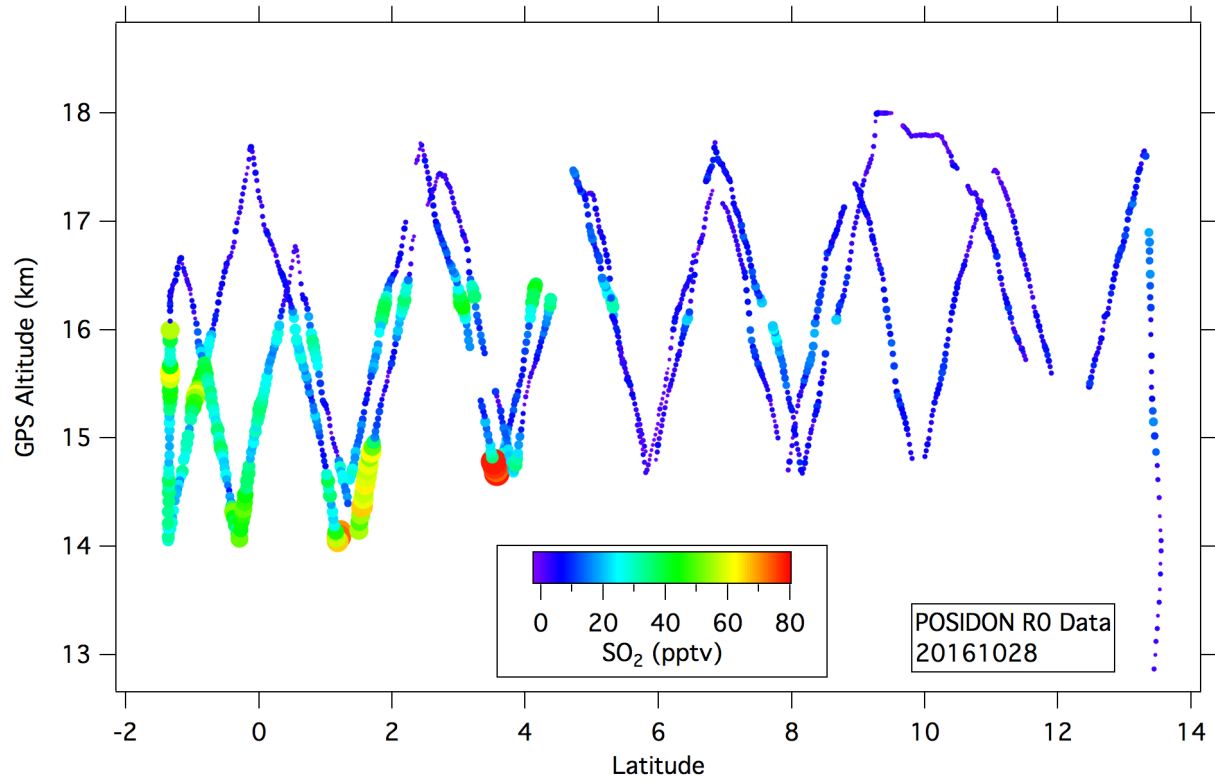


Figure 2. Latitude-height cross section of SO₂ mixing ratio. Two distinct layers were apparent north of the equator, with the upper layer extending further north.